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INTERRELATIONSHIPS BETWEEN BIOLOGICAL RHYTHMS WORK-REST SCHEDUL--ETC(U)
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## (6) Interrelationships Between Biological Rhythms Work-Rest Schedules and Task Performance.

by

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## I. INTRODUCTION

This report documents the work ~~which has been~~ carried out in the Laboratory of Human Chronophysiology of the Department of Neurology at Montefiore Hospital, supported in full or in part by Office of Naval Research (ONR) Contract #N00014-76-C-1071 for the period September 1, 1976 to March 1, 1977.* These funds are being used for two major purposes. The first is to modify the existing facility and upgrade certain equipment which is used to study human beings living in an environment free of time cues and so that we can study two subjects simultaneously. Once these modifications are complete, the remainder of the funds are currently being used to obtain normal baseline studies on healthy young men living in this schedule-free environment for 25 day periods. This report will be divided into 3 sections: Modification of Facility, Collection of Data, and Summary.

## II. MODIFICATION OF FACILITY

* The Two efforts discussed here consist of the modification of

### A. Reconstruction of Space

One of the major purposes of this ONR contract was to allow us to develop the capability of studying two subjects simultaneously so that we would be prepared to study the effect of a naval watch rotation schedule on the physiological, psychological and performance circadian rhythms in young adult males. To that end, it was necessary for us to discontinue our ongoing studies for a period of approximately two months. During that time, the entire laboratory was renovated and reconstructed. All facilities for the care and monitoring of the study subjects were centralized in an enlarged "control room" area. This additional space allowed the control room to be subdivided into three distinct but adjoining areas. The east

specimen (blood and urine) which are obtained in these studies. A laboratory counter top was installed to allow more efficient processing of samples. All of the electronic monitoring equipment was relocated in a central control room area. Finally, the west control room area was made into a kitchen, complete with a full size sink with hot and cold running water. The entire control area now occupies approximately 380 sq. ft.

In order to prevent control room noises from disturbing or influencing the behavior of the subjects living in the adjacent experimental suites to the east and west of the control room, special aluminum covered acoustic tiles were installed on all walls and doorways which separate the control room from the study areas.

Due to the expansion of the central control area, it was necessary to relocate the previously existing experimental suite. This was accomplished by the installation of two new self-closing, heavy duty fire doors in the existing corridor. The dividing partition between the bedroom and study room of experimental suite #1 was partially opened up, so as to make those two rooms adjoining. This, together with a large adjacent corridor has made the entire living space much more open and attractive. Existing air conditioners were replaced with new 9,000 btu window air conditioning units which can be operated for circulation either in the summer or in the winter. These units were sealed into the window frame. The window was made light-tight by first painting the existing glass black, then applying a layer of aluminum-backed fiberglass insulation and finally facing it with ½ inch thick gypsum board. All joints were taped and plastered before being repainted. This treatment was applied to all windows and skylights in experimental suites #1 and 2.

Experimental suite 1 is adjacent to the east wall of the control room, whereas the area just west of the control room was used for construction of experimental suite 2. The design and dimensions of the bedroom and study room in experimental suite 2 are exactly the same as those of experimental suite 1, except that suite 2 is a mirror image of 1. Both bedrooms are directly adjacent to the central control room and recording area, which allows polygraphic recording of sleep simultaneously from both areas. As in experimental suite 1, the bedroom and study room in experimental suite 2 are adjoining. In addition, special fire doors in the existing corridor had to be constructed in subject area 2 in order to maintain temporal isolation of that facility from the outside world. This involved the installation of three corridor partitions as well as the installation of a new dry wall partition to occlude a previously existing doorway from the subject's bedroom into that corridor. It was also necessary to install a new bathroom (lavatory, toilet and shower) facility.

In addition, electrical work was done to allow the operation of sophisticated electronic equipment and kitchen utensils. Five new circuit lines were brought into the area. More convenient relocation of many wall receptacles and installation of incandescent rather than fluorescent lighting in the experimental suite areas were also carried out. The entire 2500 sq ft of space was repainted.

B. Equipment

1. Temperature recording

In order to record body temperature simultaneously from multiple sites on each of the two subjects at very frequent intervals (e.g. once every minute), a Digitec data acquisition system was purchased from the United Systems Corporation (subsidiary of Monsanto). This system has the capability of scanning and recording, on punch paper tape, temperature readings of up to 20 thermistor temperature probes (Yellow Springs Instrument Company series 700. In our studies, we record core body temperature (rectal), skin temperature from multiple sites and room temperature for each subject. Five such channels of temperature data are currently recorded on each of the two subjects every minute, together with the time. This data acquisition system was mounted in an electronic desk console unit custom built by Optima Enclosures (a division of Scientific Atlanta, Inc.). The use of this electronic desk unit allowed us to consolidate most of our electronic equipment to one central location.

Two additional recording systems were interfaced with the Digi Tec acquisition system to allow the recording of special information in-between the temperature scan cycles. The master control panel for both of these systems is housed in the electronic desk unit. The first of these is an event recording system. The United System Corporation designed and built for us a special interface unit to which we attached our own event recorder unit built in the electronic workshop of our laboratory. This event recorder unit was built by Mr. Edward Costigan who is in charge of the bioengineering division of our department. It was designed to meet two goals: 1) immediate recording on punch paper tape at the time that certain important events occur during the course of a study (e.g. the time subject #1 decided to get up on a given "morning" or the time subject #2 decided to eat lunch, etc)

and 2) indirect communication with the technician from the subject about certain decisions of the subject (e.g. the time to go to sleep) which might otherwise be influenced by an interaction between the technician and the subject. In order to accomplish those two goals, our event recording system is made up of a series of 15 lighted "dual-panel" push button momentary action switches located in convenient groups within each subject area. The subject presses one of these buttons in order to record and communicate whatever it is that he wishes to do. Each of the 15 buttons in both the subject areas are separately coded by the interfacing device purchased from United System Corporation to punch out a separate code number on the punch paper tape. Thus we are able to keep track of specific activities each subject is engaged in throughout each "day." Whenever either subject presses such a button, an appropriately coded lighted push button switch also lights up in the master control panel of the event recorder system located in the electronic desk unit in the central recording area. This indicates to the technician what each subject is doing. When the monitoring technician has recorded that information in the subject's log book and/or taken the appropriate action which such a request requires (such as the preparation of a meal), he then presses "off" the lighted push button switch in the master control panel.

The second system which is interfaced with the Digitec data acquisition system is one designed to automatically record subjective assessment by each subject of his "level of alertness" at a given time. The system involves the use of a linear potentiometer (8 inch stroke, 100,000ohms), purchased from New England Instrument Company and specially packaged for us by Modular

Electronics Company. The unit can be selectively connected to one of our recording channels on the Digitec unit. The subject is instructed that the linear position of the adjustable lever on the unit is an indication of his state of alertness. He is told that the more alert he is, the higher he should move the lever. Once he sets the lever, he then initiates the recording by pressing a specific lighted push button switch from the event recorder unit. This records his selected linear position on the data acquisition system. The number is then directly correlated with the linear position which he set on the alertness scale apparatus. In this way, automatic digital recording of the subject's subjective rating of alertness can be accomplished in a matter of a few seconds. Finally, there is a comparator and an alarm panel on the electronic desk unit which constantly monitors the core body (rectal) temperature of each subject being studied. If this temperature falls out of the normal physiologic range (e.g. due to the rectal temperature probe falling out or the subject developing a fever) an alarm sounds, immediately indicating to the monitoring technician that this should be investigated and proper action taken.

2. Polygraphic Recording

In order to polygraphically record the sleep patterns of two study subjects simultaneously, a 12 channel Model 78 Grass Instrument Company electroencephalograph unit is being used. Since such units were designed to accommodate the recording of only one subject at a time under normal conditions, the bioengineering division of our department designed and built a special interfacing connector unit. Two custom made extension

cables with mini-electrode boards were made for us by Grass Instruments, Inc. We are now able to separately record 6 electroencephalographic channels from each subject on the same polygraph unit simultaneously. Of course, an entire set of small Beckman surface electrodes and the apparatus necessary for their application had to be purchased for the second subject. Another mobile electrode cart was made up to allow fast application of the electrodes during the bedtime procedure. During the reconstruction of the space, several failing amplifiers from this unit were exchanged for rebuilt units from Grass Instrument Co. In addition, the entire writer unit was returned to Grass Instrument Co. and reconditioned complete with 12 oscillographs for remagnitization and realignment. A new set of pen adaptors and sapphire tipped ink pens were also purchased to improve the output of the unit.

A Tandberg Series 100 FM instrumentation recorder which we have on loan from the National Aeronautics and Space Administration was connected to our Model 78 polygraph by a set of special cables. This allows us to record on magnetic tape four channels of polygraphic information during each "night" of recording. We intend to rack mount this high quality instrumentation recorder in our electronic desk unit in the near future. The use of this unit will allow us to do special computer analysis of the electroencephalogram from the subject's polygraphic sleep recordings which we would otherwise be unable to perform since the recordings are normally made only on paper.

3. Subject Monitoring and Video Equipment

An intercom unit capable of 12 separate microphone inputs and selective speaker outputs was built to allow communication with either subject area

individually. The subjects press a "talk" button when they wish to communicate with the technician on duty. An indicator light in the control panel shows which subject is initiating a conversation. The electronic desk unit also accommodates the close circuit video monitoring of each subject area. This includes operation of a bi-directional camera sweep unit in one of the subject areas.

4. Collection of Biological Specimen

In order to insure accurate recording of the timing of blood samples in experimental suite 1, the I.V. pole was wired with a lighted push button switch from the event recording system described above. This switch is pressed by the technician when each blood sample is taken and records the exact time of each sample. Another special unit was designed and built by our bioengineering division to insure that the time of centrifugation of each sample is the same throughout the experiment. The unit allows the technician to set the centrifuge timer to a set number of minutes. This unit starts the centrifuge, then stops the centrifuge after a fixed time, and also indicates to the technician with a tone when the operation is complete.

5. Kitchen

The kitchen area was improved by the addition of a sink mentioned in the section on reconstruction as well as the purchase of a 20 cubit ft. frost-free refrigerator-freezer unit. Several kitchen cabinets were installed for convenience and the kitchen appliances placed on a long formica-topped table.

6. Computer Supplies and Equipment

In order to deal with the voluminous data generated by the data acquisition system from these studies, it was necessary to considerably upgrade our Hewlett Packard 2100A computer. This included providing programming modification to the operating system to allow multi-program, multi terminal operation. A time based generator and floating point hardware was purchased from Hewlett Packard. In addition 16K words of computer memory were purchased from Fabri-Tek Inc. This increased the total CPU memory capacity of the computer to 32K. In order to process the 3,000 feet of punch paper tape punched out each day by the Digitec data acquisition system, a high speed General Electric paper punch tape reel/rewinder was added to feed tape to our high speed paper tape reader. Finally, multiple high density disk pack cartridges were purchased to store and back-up the data which is obtained from each subject.

7. Performance Task

In order to replace the "speed of card-sorting" performance task which we had been using previously with something which might be more relevant to the tasks required aboard ship, we borrowed for testing purposes a "Whitehill welding simulator." After a variety of preliminary tests using the "simulator," we installed it in Experimental Suite number 2. The instrument measures the interaction of complex psychomotor skills and may prove to be an indicator of a subject's ability to "perform" on the job. It is presently on loan to us from Modular Electronics Company.

8. Furnishings for Experimental Suite Number 2

In order to provide entertainment for the experimental subjects during their prolonged stay, the "apartment" was equipped with a high quality stereo

amplifier (without receiver) together with speakers and a turntable. A Walton-Commodore Exercycle was also purchased to provide physical exercise. Experimental Suite number 2 was also equipped with kitchen equipment and utensils including a hot plate, an electric broiler-oven unit, a small refrigerator and a freezer.

SECTION C - PERSONNEL

Since the number of tasks required of the technician on duty has increased with the increasing demands of these studies, it has become necessary to institute a series of protocols and check-lists (See Appendix ). The specifics of these has only been possible as the study has evolved and the procedures have become standardized. Development of these protocol sheets has significantly facilitated the training of new personnel as well as maintaining standards among existing personnel. Check-lists are used at every shift change, and we schedule a half hour overlapping period at each shift change to allow a de-briefing period for the departing staffer as well as a re-orientation period for the arriving staffer. The shift change overlap interval is also used to make routine checks of our continuously operating electronic equipment. Check-lists are also used for certain critical events such as wake-time and bedtime in order to insure that certain routine procedures are carried out. Finally, in order to make certain that the technicians are always ready to perform certain tasks which require a high level of speed as well as proficiency, a performance record is kept for each one of our personnel. In order to be eligible for scheduling on up-coming shifts, each technician must demonstrate within the previous 7 days of the assigned shift that they have performed the tasks well by objective measurements and within a certain time period. This is the only way that we can be sure that our entire staff is always ready to meet certain critical demands at any time. This is particularly true of the bedtime procedures, which must be carried out very quickly in order to avoid delaying the subjects chosen time of going to sleep.

III: COLLECTION OF DATA

Since our pilot study (3 subjects) in the summer of 1975, we have completed four additional normal studies under a new and more demanding protocol. Each of the four subjects lived in one of our special apartment complexes for 25 consecutive sidereal days. During that entire time, they were not allowed to know what time it was. Many physiologic indices were measured frequently during their stay in the unit. These included minute-by-minute body temperature recording, (from multiple sites) as indicated above; "nightly" sleep stage patterning by polygraphic recording; continuous definition of the circadian episodic secretory patterns of cortisol and human growth hormone as measured in the plasma; a subjective, self-reported, frequent estimate of alertness; urinary volume, and electrolytes, and intracellular (red blood cell) potassium. The experimental protocol consisted of 3 different stages, stage A consisted of the adaptation and baseline period. The subjects were on a scheduled 24 hour regime of lights on and lights out time for day 1, 2, 3 and 4. Although the subjects were not aware of the time of day during this period, they were put to bed every night at a time calculated from their own diary which was their average time of going to bed. They were awakened each morning at the time when they had reported in their diary their usual time of waking. They continued on that schedule during this stage of the experiment. Their usual time and number of meals, as determined by interview, were also continued on the same schedule. Urine samples were collected whenever the subjects took a meal, whenever they woke or slept, as well as when they wished to urinate.

Blood samples were drawn very frequently from an indwelling venous catheter. The interval between these samples varied randomly from 16 to 24 minutes to prevent the subject from using the sampling interval to estimate elapsed time.

Stage B of the experiment consisted of 16 sidereal days but a variable number of sleep-wake cycles. After going to bed at lights out time on Day 4, the last day of 24 hour scheduled activities, the subject was free to wake and get out of bed at any time he wished on Day 5. Urine and blood samples continued to be taken throughout this time. During Stage B, the subjects determined the timing of their meals and informed the technician when they wish to eat by pressing a meal request button. This same system was used to record the time of urination as well as other special events such as showering and exercising. During this stage, the subjects indicated the time that they would like to go to bed for the night by pressing a similar button. The subjects had been asked not to nap but instead to go to sleep for an entire "night." The subject was then allowed to wake whenever he wished.

This was continued until the last five sidereal days of the experiment (e.g. day 20). At that time, the mean period length of the subject's sleep-wake cycle was calculated. If it fell within the circadian range (20 to 28 hours) then the mid-sleep time on day 20 as predicted from a linear regression analysis was used to schedule his lights-out time and his lights-on time on that day.

Stage C was a return to a fixed 24 hour day. Stage C of the experiment, which was a rescheduling period, consisted of at least five scheduled sleep periods. These sleep periods were scheduled in phase with the subject's expected free-running sleep period so that the change to a rescheduled day involved only a change of period length for each subject and not an acute change of phase position.

During this entire stage of the experiment, the timing of meals was set by the experimenter as well as the timing of lights-out and lights-on. The length of the lights-out period and the lights-on period were the same as they had been in Stage A for a given subject.

## IV. ANALYSIS OF DATA

The bulk of our analysis time has been spent developing programs to store the large quantities of data which we have collected into efficient and easily accessible computer files. We have therefore developed programs to efficiently load the paper punch tapes from the data acquisition system and to edit those temperature files once they are placed on a disc. We have developed graphing programs to allow us to visually examine the data, and are presently adapting the statistical analysis programs previously developed to be applied to the more detailed data obtained on these studies.

We have recently designed and developed a computer program which will be very helpful in the study of circadian rhythms of sleep stage analysis. The technique facilitates pattern recognition both within an individual night and across multiple successive nights in sequence. Intra-sleep circadian rhythmic changes and the timing of each sleep period in relation to those preceding and following are displayed for analysis.

The interpretation of these data awaits further extensive analysis. This includes completion of the time consuming hormonal assays of 7500 samples collected to data and the loading, editing and statistical analysis of this data.

## V. SUMMARY

In summary, we have accomplished the goals set out on pages 46 and 47 of our contract proposal. We have: 1) completed the required renovation of our research area to allow the simultaneous measurement of two independent human subjects maintained in an environment free of time cues for extended periods; 2) designed and purchased

the equipment necessary to allow such simultaneous measurements to be made; 3) developed the measurement, data acquisition techniques, and some of the data analysis procedures to be applied to the data which we anticipate from this ONR proposal; and 4) trained a full staff of laboratory personnel to meet these special requirements, including the additional staff needed to study two subjects concurrently. Due to administrative problems which delayed the initiation of funding for our ONR proposal, we were not able to complete the above four goals in time to also complete a special pilot study. However, we are currently studying the effect of brief interruptions (½ hour) of sleep on a long term free-running circadian rhythm. These interruptions were designed to be much like the "evolutions" or emergency repair simulations which are carried out on board naval nuclear submarines. However, it is too early to report any conclusions. We should be finished with our first subject under that long-term (3 month) protocol on April 15th.

The renovation and reconstruction work was carried out successfully by outside contractors supervised by our own engineering department in the hospital. We now have two separate 3 room living areas connected to a central recording control equipment area with shared data acquisition and polygraph units and a common kitchen as well as a common area for handling biological specimen. These upgraded facilities will enable us to carry out the protocol which we are proposing in the renewal section.

Finally, we have obtained and put into operation the necessary computer hardware and software to allow us to handle the data which is being generated from these experiments. These are now fully operational on our HP2100A computer. Thus we are currently prepared to collect and analyze all the information proposed in our current renewal application.

Each of the protocols in the four 25 day experiments carried out in the past six months were successfully completed. The subjects were clearly isolated from temporal cues, as evidenced by their own behavior in our environment as well as reports of their perceptions while in the environment. This was accomplished in spite of the fact that the subjects interacted with the members of our randomly scheduled staff. Furthermore, the collection of the temperature data was accomplished every minute throughout the 100 days of the studies with a cumulative loss of perhaps 200 or 300 minutes (out of 144, 400 minutes) due to equipment failure. Approximately 1800 blood samples were collected from each subject and are currently being assayed for cortisol and growth hormone in our laboratory. Nearly every urine specimen was collected, aliquoted into two separate containers and frozen for subsequent chemical assay. Some 1200 alertness scales were also taken during the waking hours of each subject. The polygraphic records of each of the 95 sleep periods of recording were all successfully obtained. They are currently being scored into the sequential different sleep stages by one of our specially trained technicians. The simultaneous recording of these records on magnetic tape was accomplished successfully for some 83 of the 95 sleep periods.

In addition to these studies using our standard protocol, several other studies in temperature regulation have been carrid out. These have involved manipulation of the timing of a subject's sleep-wake cycle with respect to his normal time of waking and sleeping. During these studies, core (rectal) body temperature as well as several skin temperatures were concurrently monitored on both baseline and experimental nights.

# APPENDIX

THE LABORATORY OF HUMAN CHRONOPHYSIOLOGY

FREE RUNNING STUDY

CARD SORTING PERFORMANCE TEST PROTOCOL

1. The card sorting performance test should be administered at the following times.
   A. Before any meal which consists of more than a beverage (e.g. milk and cookies).
   B. Before bedtime.
   C. Just after wake time.
   D. Whenever S decides to urinate, except during his sleep period.
2. The performance test should be done before the subject gets up to urinate or before he begins preparation for bed.
3. The card deck must be shuffled at least 10 times by the technician in advance.
4. The test should be done with the subject sitting at a desk.
5. The technician issues a START statement and times on a stopwatch the duration of the procedure.
6. The procedure involves the subject sorting the deck of cards into red and black cards. There should be 96 cards in the deck. These consist of 12 sets of the cards 1 through 8, half of them red and half of them black.
7. Subject may not pick up missorted cards once laid on the desk. These mistakes should be counted by the technician.
8. Record the number of mistakes as well as the number of cards which fall to the floor on the card sorting performance test record sheet, together with the time and the stopwatch interval.
9. The subject may be told the time "score" and the number of errors on his performance test.

NAME
CODE #

PAGE #____

## CARD SORTING PERFORMANCE TEST
## LOG SHEET

| DATE | TIME (clock hour) | TIME (minute #) | TIME STOPWATCH | # ERRORS | # DROPPED | INITIALS |
|---|---|---|---|---|---|---|
| | | | | | | |

# FREE RUNNING STUDY

## MEAL PROTOCOL

1. Always record the time (cumulative minutes number) that a meal is requested, as well as the time that the meal is actually begun and finished in the meal record sheet.
2. On scheduled days, the meal times are also scheduled. Check the chart on the freezer door to see what meals are scheduled when.
3. On scheduled days, 40 minutes before the scheduled meal time, check the menu on the refrigerator door. Begin preparing the appropriate meal, then ask the subject to press the meal request button.
4. On free running days, when the subject initiates the meal preparation by pressing the meal request button, record the time he presses the button and ask him which meal he is requesting (i.e. breakfast, lunch, dinner or snack). Check the menu on the refrigerator door and begin preparing the appropriate meal.
5. Before serving a meal, administer a card sorting performance test and then collect a urine sample. Be sure to administer the performance test before the subject gets up to urinate. The performance test and urine collection are not necessary only if the subject requests simply a beverage.
6. Remove all foods from their original packing and place into appropriate paper or plastic container. Be sure the food served is not in dated carton. Use a cup, not a carton, for milk. Place his meal on a serving tray and bring it in to the subject.
7. When you bring the meal into the subject, be sure to press the meal-served button. This is very important.

8. The subject is allowed additional"seconds" on food given at meals. Indicate on the menu any second helping, substitutions, additions or food not eaten.

9. The subject is allowed non-scheduled, additional small snacks, even on scheduled days (e.g. milk and cookies).

10. When subject finishes his meal, remind him to press the meal-finished button.

11. Wash all utensils used on your shift.

12. After breakfast clean electrodes and make bed with clean sheets. After lunch, hang electrodes. At dinner request, turn on polygraph amplifiers and make a new calibration with settings used for recording purposes. Be sure to initial, date and sign this calibration.

NAME

CODE #

PAGE #_____

## MEAL LOG SHEET

| DATE | MEAL TYPE | TIME REQUESTED (MINUTE #) | TIME BEGUN (MINUTE #) | TIME FINISHED (MINUTE #) | INITIALS |
|---|---|---|---|---|---|
| | | | | | |

THE LABORATORY OF HUMAN CHRONOPHYSIOLOGY

FREE RUNNING STUDY

URINE COLLECTION PROTOCOL

1. Always require a performance (card sorting) test before collection a urine sample, whether or not it is before a meal or spontaneously. (But not during sleep period, when S should be disturbed as little as possible, and only hall light should be turned on.)

2. Urine collection button should be pressed as close as possible to the actual time of urination, not when S requests to do so.

3. Record time on the urine collection sheet with sample number.

4. Measure the urine volume in a graduate cylinder. All urine is to be saved. Record this volume on urine collection sheet.

5. Transfer urine from graduate cylinder to an appropriately sized plastic bottle(s). See chart on freezer to choose bottles for a given urine volume.

6. If more than one plastic bottle is used for a given sample, label each with the appropriate sample number and the suffix A, B, C, etc.

7. Remove enough urine from one of the plastic bottles to fill a red-stoppered tube to the bottom of its label. Each red-stoppered test tube has been labelled and pre-treated with sulfuric acid. Do not remove the acid or return any urine once placed into a red-stoppered tube back into a plastic bottle.

8. Take the syringe with a 19 gauge needle and puncture the red-stopper. Do not allow the needle to touch the urine. If it does, replace the syringe and the needle. With the needle in the air space, draw up about 10 cc. of air and withdraw the needle from the tube. This is to reestablish the vacuum in the tube. Put the bottle(s) and the tube in the freezer.
9. Place a band around the cards which were used in the performance test and place them in the box marked unshuffled. Shuffle the cards at your earliest convenience.
10. Immediately wash the urinal and the graduate cylinder. Rinse three times using cold water from our kitchen sink and leave both items upside down to drain in the designated location on the tapeboard.

NAME
CODE #

PAGE #_____

# URINE COLLECTION LOG SHEET

| DATE | SAMPLE # | INTERVAL (clock hour) | INTERVAL (minute #) | VOLUME | INITIALS |
|---|---|---|---|---|---|
| | | | | | |

:ODE Scheduled_____

BEDTIME CHECKLIST

TE_____SLEEP PERIOD_____ STAFFER_____ HELPER_____

1. Did you re-calibrate polygraph with time of calibration noted on sleep record? yes__ No_

2. Was the tape recorder digit counter set on zero and were calibrations tape recorded? Yes__No_

3. Did you note time of initial bedtime request button press in log? Yes____ No_____
Time (clock hour)_____Minute #_____

4. Did you ask subject to wash with the facial scrub? Yes_____No_____

5. Did you administer a performance test (before collecting urine)? Yes_____No_____
Minute #____

6. Did you collect a urine sample? Yes_____No_____ (Minute #_____ (#___).

7. Did you place gel in electrode cups? Yes_____No_____.

8. Did you check that proper array was punched out on polygraph selector panel?_____

9. Did you set air conditioner thermostat temperature to his liking for the night (Air Conditioner must be running, but setting is variable)? Yes_____ No_____

0. Did you shut off monitor and camera? Yes_____ No_____

1. After he was LYING IN BED FOR THE NIGHT, did you ask subject and did he check that temperature probe was securely in place? Yes____ No_____.

2. Did you give him an alertness scale just prior to lights out? Yes_____No_____.

3. Did you flip his day/night toggle switch to the "night" position? _____

4. Are all room lights off and doors shut? Yes____ No._____

5. Did you turn off hall lights? Yes_____No_____

6. Was an arm wrap necessary? Yes_____No_____

7. Are IV tubing and probe cables taped to head of bed? Yes_____ No _____

8. IV bottle volume_____

Time Interval Between Drops (Sec.)_____

9. Did you reset the low temp. limit on Rex to 96.10°F? Yes____No_____

0. Is the hole in the wall corked with cloth? Yes____No_____.

| | Minute # | Clock Hour |
|---|---|---|
| Request Sleep | | |
| Hookup Begun | | |
| In Bed | | |
| Lights Out | | |

DURATION OF HOOKUP____

1. IS POLYGRAPH SET IN "RECORD" POSITION? _____ VERIFY TAPING BY FLIPPING TO PLAYBACK, MARKING RECORD, AND RETURNING TO RECORD POSITION. _____

CODE #

Scheduled_____

## WAKETIME CHECKLIST

DATE_____ SLEEP PERIOD#_____ PRIMARY STAFFER_____ HELPER_____

1. Turn on hall light? Yes_____ No_____.

2. Record time of dim light onset Minute#_____ Hour _____ and of full light onset Minute#_____ Hour_____.

3. Did you turn on video camera and videomonitor? Yes_____ No_____.

4. Were all electrodes still well placed when S awakened? Yes___ No___. If not, please record and explain:

5. Did you administer performance test before collecting urine? Yes___ No___.

6. Did you collect urine specimen on awakening? Yes___ No_____. Minute#_____ U#_____

7. Did you give him wake time alertness scale? Yes___ No___.

8. Did subject wake, get out of bed, and wash up right after electrodes were removed? Yes_____ No_____. Time (clock hour) _____ Minute# _____.

9. What was his weight? _____. Had he defecated beforehand? Yes___ No___.

10. Did you turn air conditioners to his liking? (Air conditioner must be running, but setting is variable). Yes _____ No_____.

11. Did you flip his day/night toggle switch to the "day" position? _____

12. Did you clean the electrodes? Yes___ No_____.

13. Did you soak the electrodes in salt water solution? Yes_____ No_____.

14. Did you recalibrate polygraph at end of sleep record, noting time? Yes___ No_____.

15. Did you clean the polygraph and put in a new paper supply? Yes___ No___.

16. Did you calibrate and register I.D. information on the polygraph and tape recorder? Yes_____ No_____.

17. Did you enter sleep record identifying info. in log book on REX? Yes___ No___.

18. IV Bottle Volume (ml) _____ _____. Interval between drops (sec) _____

19. Is the hole in the wall corked with cloth? Yes_____ No_____.

20. Did you reset the low temperature limit on REX to 97.70°F? Yes_____ No_____.

NAME
CODE #

"WELDING" PERFORMANCE TEST
LOG SHEET

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| DATE | TIME (clock hour) | TIME (minute #) | FIRST TRIAL & SECOND TRIAL & THIRD TRIAL | INITIALS |
|---|---|---|---|---|
| | | | | |

NAME:
CODE #

## SHIFT CHANGE CHECKLIST

Arriving Staffer_____ Departing Staffer_____

Shift Time Interval_____ Shift Time Interval_____

Dates_____ Dates_____

DEPARTING STAFFER

1. Have you made summary entry into log? Yes_____ No_____
2. Is the IV cart stocked? Yes_____ No_____
3. Have you washed all kitchen utensils used during your shift? Yes_____ No____
4. Have you verified that the items on his upcoming menu and other supplies will be on hand in case Subject awakens during our night? _____, Call dietician (weekdays 9 a.m.-5 p.m.) if food supply is low.
5. If near subject's lunch time, have electrodes been hung?_____
6. If near subject's dinner time (or if subject is sleepy on free-run), have the polygraph and tape recorder been turned on and have the calibrations been made?_____

ARRIVING STAFFER

1. Have you removed your watch? Yes_____ No_____
2. Have you washed your hands before blood sampling? Yes_____ No_____
3. Have you read entire log since your last shift? Yes_____ No_____
4. Is punch paper tape machine working?_____(i.e. paper on reel moving when it punches).
5. Have you checked to see if the samples are frozen? Yes_____ No_____

Note: Time in Total Minutes_____

Core Body Temperature_____

Skin Temperature_____

Ambient Temperature_____

IV Bottle Volume_____

Time Interval Between Drops_____